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EVALUATION OF THE LINDEN LOOPER AND SPRING CANKERWORM OUTBREAK ON MAMMOTH CAVE NATIONAL PARK, KENTUCKY 1979

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COVER PHOTO

Linden Looper

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by

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INTRODUCTION

The linden looper, Erannis tiliaria (Harr.), and spring cankerworm, Paleacrita vernata (Peck), are native forest defoliators. Their range is from southern Canada to northern Georgia, southwest to east Texas and west to the Great Plains. Apples and elms are the preferred hosts but other deciduous trees are also attacked. These include both the red and white oak groups, hickories, basswood, and maples. On the park, heaviest feeding occurred on oaks.

The linden looper emerges in the fall following a hard freeze. The wingless female climbs a nearby tree and lays from a few to over a hundred eggs in bark crevices. Eggs hatch in the spring about the time of foliage emergence. Full grown larvae are about 37 mm long, bright yellow, have rusty brown heads, and 10 wavy black lines running down their backs. Mature larvae drop to the ground and pupate in the soil before summer begins.

The spring cankerworm emerges in the spring when the ground begins to warm. The wingless females climb a nearby tree, mate and lay groups of eggs in bark crevices. Egg hatch and larval feeding coincides with leaf emergence. When full grown, larvae are reddish to yellowish-brown, yellowish green, or black and are about 18 to 30 mm long. The head is light and mottled with brown. The body is usually marked with a yellow stripe just below the spiracles, and a broad greenish-yellow strip down the middle of the venter.

Mature larvae drop to the ground and construct prepupal chambers in the soil where they overwinter. Pupation occurs in the early spring.

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METHODS

On May 31, 1979, a ground check of the park was conducted to determine the severity and causal agent(s) of reported defoliation. Due to poor weather conditions, an aerial survey could not be made.

RESULTS

The ground survey failed to detect any causal agents. Specimens collected by park personnel were identified as linden looper and spring cankerworm.

Defoliation from the ground was most severe along the drive into park headquarters, along Mammoth Cave Ridges, and part of Jim Lee Ridge. Views from Maple Springs lookout tower in the northern part of the park and from roadside overlooks did not show any signs of additional heavy defoliation.

Natural controlling organisms appeared at a high level in areas of defoliation. Insect predators include Coccinellidae (ladybird beetle) and Asopinae (stink bugs). Numerous parasitic diptera (Tachimidae) were observed.

Evidence of a polyhedral wilt virus was evident by the numerous dead larvae still hanging in the characteristic position which results from this disease. This type virus is an important controlling agent of defoliators, causing widespread collapse of high population in the third or fourth year of heavy defoliation.

ECOLOGICAL IMPORTANCE

Part of the following is a summation of a literature review by G. S. Desheft (1978). It is presented here to enable the land manager to view the current defoliation in relation to its short and long term effect on the forest ecosystem.

SHORT TERM EFFECT

The linden looper and spring cankerworm are not regarded as serious forest pests because outbreaks usually last only 2 to 4 years (Anderson, 1960). Normally, trees defoliated early in the season refoliate later in the summer with thinner and larger leaves. Growth loss occurs by reduced formation of summer wood, with an overall decrease in growth of 15 to 20 percent (Ghent, unpublished data).

The greatest impact these defoliators have are as nuisances in forested residential and recreation areas. Losses are immediate in areas where foliage contributes significantly to the aesthetic and recreational aspect of the forest. Defoliation, the presence of larvae, and frass drop reduce the recreational value of the forest.

LONG TERM EFFECT

Native forest defoliators are an integral part of the forest ecosystem. Their population fluctuations and feeding behavior are essential to overall level of ecosystem functions. Insect feeding on forest vegetation can affect nutrient level in many ways, including light penetration through the canopy to the understory, increasing rates of nutrient leaching from foliage, and escalating the fall of nutrient-rich litter. Phytophagus (plant feeding) insects are thus probably best viewed as primary regulators of forest productivity, especially through their effects on the recycling of readily metabolized nutrients (Mattson and Addy, 1975) and in the reduction of nonproductive, suppressed, and overmature trees from the ecosystem (Kulman, 1971).

Light defoliation may tend to stimulate vegetative growth and cellulose production in plants because of the improved circulation of important growth elements such as nitrogen, phosphorus, and potassium in litter fall. But production losses are generally substantial when defoliation exceeds 40 percent (Kozlowski, 1969). Nevertheless, enhancement of soil quality by defoliation suggests possible mutualistic relationships between insect defoliators and their tree hosts.

Insect defoliators are able to locate host trees through chemotactic stimuli. Insects are able to discriminate host from nonhost by recognition of certain chemical components of the foliage. In addition, certain chemicals may act as a repellant, deterrent, or toxin to the animal (Feeny, 1975). Defensive chemicals such as tannins, terpenoids, saponins, glucosinolates and others are synthesized by the plant and aid in the regul-

tion of phytophagus insect populations. The availability of nutrients within the stand will determine not only the growth of the host but also its ability to produce these inhibitory or toxic chemical compounds. Therefore, it is not surprising that many defoliators attack plants in physiologically weakened stands. Because soil nutrient levels appear to increase after successive seasons of heavy defoliation (Sondheimer and Simeone, 1970), the chemical defenses of the tree might be expected to improve. This may be a partial explanation why outbreaks usually last only 2 to 4 years within a given stand. Certain trees within the stand which are either suppressed or overmature, may be stressed to the point where they are eliminated from the stand, thereby improving the overall productivity of the stand.

Populations of native insect defoliators can be viewed as inversely related to the productivity of the forest ecosystem, perhaps being related to the overall ecosystem stability (Holling, 1973; Webster, Waide and Patten, 1975).

Clearly, the use of artificial control techniques may alleviate the symptoms and nuisance caused by the insects, but they also alter the natural regulation of the ecosystem and the long term productivity of the forest. Premature interruption of this natural cycle may only increase its likelihood of recurrence and with greater severity in the future.

RECOMMENDATIONS

Forest Insect and Disease Management recommends that no chemical control be instituted next year. Spring cankerworm and linden looper populations are normally kept under control by natural control factors. Outbreaks often occur but are of short duration, lasting only 2 to 4 years within a particular location. Due to the presence of high predator and parasite populations, as well as the presence of polyhedral wilt disease, this should hold true for the current infestation.

Isolated trees can be protected by placing sticky bands around the trunks to prevent female moths from climbing them to lay their eggs. To aid in removal of the sticky material, a band of roofing material should first be stapled to the tree and the sticky material applied on top of this.

Forest Insect and Disease Management will conduct an aerial survey of the park in late May 1980, to delineate areas of defoliation next year.

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